EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 4-04

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-D-14-031	10/01/2014 To 09/30/2019 Base Option Period Number 4	AEROALLERGENS AND WILDFIRES

Contractor: INDUSTRIAL ECONOMICS, INCORPORATED

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 10/01/2018 To 09/30/2019

Comments:
THE PURPOSE OF THIS ACTION IS TO INITIATE WA 4-04 "IMPROVE BENMAP-CE TOOL TO QUANTIFY THE IMPACTS TO HUMAN HEALTH OF AEROALLERGENS AND WILDFIRES" FOR AN INITIAL LOE OF 300 HOURS FOR START UP WORK. THIS WORK DOES NOT DUPLICATE ANY WORK PREVIOUSLY PEFORMED UNDER MY AUTHORITY.

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 10/01/2014 To 09/30/2019 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Allison Crimmins (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	202-343-9170
	FAX Number:	
Project Officer Name: Lorraine Reddick (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	202-564-1293
	FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Contracting Official Name: Andrew C. Flynn (Signature) 10-3-18 (Date)	Branch/Mail Code:	
	Phone Number:	919-541-2674
	FAX Number:	919-541-0611

I. TITLE: Improving the Ability of the BenMAP-CE Tool to Quantify the Impacts to Human Health of Aeroallergens and Wildfires

II. WORK ASSIGNMENT MANAGER (WAM):

Allison Crimmins
EPA, OAR, OAP
6207-A
Washington, DC 20460
202-343-9170

Neal Fann
EPA, OAR, OAQPS
C539-07
RTP, NC 27711
919-541-0209

III. LEVEL OF EFFORT:

Hours :
Duration: 12 months (October 1 2018—September 30, 2019)

IV. BACKGROUND:

In 2003 the U.S. EPA contracted with a developer to create version 1.0 of the environmental Benefits Mapping and Analysis Program (BenMAP). That tool systematized a number of the steps of a health impact and benefits analysis that had previously been performed using the Criteria Air Pollutant Modeling System (CAPMS). Subsequent versions of BenMAP incorporated a number of new features, including a database that could be modified by end-users, more spatially resolved baseline health data and a broader array of health impact functions.

Beginning in 2011, the U.S. EPA began redeveloping the tool from the ground-up to meet two goals: (1) create an open-source software platform so that anyone could see the software code and improve the program; (2) improve the performance, accessibility, capabilities and usability of the software. In the Fall of 2013, after iterating through dozens of beta versions, the U.S. EPA released version 1.0 of the environmental Benefits Mapping and Analysis Program—Community Edition (BenMAP-CE). In the winter of 2015, the Agency released version 1.1 of the software, which addressed a number of bugs identified in version 1.0 and incorporated several new features designed to make it easier for non-U.S. analysts to apply the program.

Under the last work assignment (EP-D-14-031, Work Assignment 3-04), the Contractor improved the ability of the BenMAP-CE tool to quantify human health impacts attributable to stressors including aeroallergens and wildfires. This work assignment builds upon this work by directing the Contractor to consider a broader range of health outcomes in the air pollution-health relationship.

V. STATEMENT OF WORK (SOW):

The Contractor shall conduct the following tasks in accomplishing the objective of this Work Assignment.

Task 1: Develop a work plan and project plan
The Contractor shall develop a new work plan and update the system design document as described below.

Task 1.a: Develop work plan and administer project
Within 20 calendar days of the effective date of this WA, the Contractor shall submit a work plan to the Work Assignment Manager (WAM). The Contractor shall arrange and conduct an initial phone conference with the WAM within one week of the WAM approving the WA. Subsequent to this initial teleconference, the Contractor shall lead regular phone conferences on at least a weekly basis to discuss work progress and any issues associated with the work tasks. The Contractor shall prepare an agenda for such weekly meetings, record meeting minutes, and distribute such meeting minutes to all participants.

Task 1.b: Update the system design document
To the extent that any of the tasks below require the Contractor to modify the BenMAP-CE software, then the Contractor, consulting with the WAM, shall develop a comprehensive and detailed project plan for each task in this WA, specifying clearly the technical and functional basis for the new software version:

- The minimum design characteristics of the new software
- A workflow describing the expected inputs and outputs of each new program algorithm, including example use cases.
- Desired behavior of the graphic user interface, including sketches of windows, location of hover text, etc.
- Protocol for quality assuring each new feature.
- Sequence in which the Contractor will address the tasks below.

The Contractor shall not modify the source code until the WAM approves this project plan. The Contractor shall develop the system design document for each new BenMAP-CE feature on a rolling basis and in consultation with the Work Assignment Manager.

Deliverables:

1.1. Work plan
1.2. System design document

Task 2: Improve the approach for quantifying aeroallergen-modified air pollution risks
Under work assignment 3-04, the Contractor developed a manuscript for publication on the impacts of temperature and precipitation on future pollen concentrations, and the subsequent health and economic burden of those changes, focused on three pollen types (oak, birch, and grass), across the continental US, with impacts expressed for an asthma emergency department visit endpoint. The manuscript outlined research needs, including the need to: 1) expand coverage to other pollen types; 2) expand coverage to additional health endpoints; 3) provide a more complete assessment of the economic impact of this health burden, identifying any gaps in the database of

Willingness to Pay and Cost of Illness measures in the BenMAP-CE tool; and 4) consider the health implications of the joint impact of exposure to aeroallergens, extreme heat, and air pollution using the multi-pollutant/multi-stressor version of the BenMAP-CE tool as needed. The Contractor shall proceed in three stages: (1) developing a memorandum; (2) modifying the BenMAP-CE code as needed; (3) applying the methodology in a journal article for peer review.

Task 2.a: Memorandum

The Contractor shall write a memorandum describing the potential to use new epidemiological research from the U.S. Centers for Disease Control and Prevention to expand coverage of pollen type and health endpoints in projected aeroallergen impacts on human health. The memorandum shall further consider the role of multiple exposures to meteorological (e.g. temperature and humidity), air quality (e.g. ozone and particulate matter) and contextual (e.g. air conditioning prevalence) parameters when specifying and applying multi-stressor concentration-response functions. The memorandum shall describe a proposed methodological approach for quantifying aeroallergen effects in BenMAP-CE, including data sources, proposed outputs/metrics, and anticipated challenges/limitations. This information shall support the system design document in task 1 above.

Task 2.b: Modify the BenMAP-CE code

To the extent needed, the Contractor shall re-parameterize the BenMAP-CE program to incorporate new concentration response functions to quantify the effects identified in Task 2 above, including the ability to assess additional economic impacts of more comprehensive health burden estimates (e.g. direct cost of illness; lost workdays or schooldays). The Contractor shall modify v1.4 of the program previously developed to perform multi-pollutant analyses. The Contractor shall modify BenMAP-CE so that:

- Users can account for effect modification of air pollution effects by aeroallergens
- Users can define aeroallergen parameters in the program
- Users can assign health impact functions easily to a large number (e.g. >50) user-defined discrete geographic areas.

As above, these changes may require the Contractor to modify the user interface, program logic, and user manual. For these reasons, the Contractor shall reference closely the system design document and consult regularly with the WAM. The Contractor shall not modify the source code until the WAM approves this project plan.

Task 2.c: Manuscript for peer review and publication

In coordination with EPA staff, the Contractor shall develop a manuscript describing the new aeroallergen impacts modeling approach and results. The manuscript should carefully document the inputs, assumptions, and limitations of the approach. The Contractor shall submit the manuscript to a peer-reviewed journal, revise the manuscript accordingly based on reviewer comments, and be prepared to secure open-access publication.

Deliverables:

2.1 Approach memorandum
2.2 Modified version of BenMAP-CE and user manual
2.3 Manuscript for publication

Task 3: Quantify future wildfire-attributable $PM_{2.5}$ mortality impacts

Under work assignment 3-04, the Contractor analyzed the health impacts of wildfire-related PM exposures in the western U.S. under alternative future temperature and precipitation scenarios using the GEOS-Chem High Performance (GCHP) on Harvard University's Odyssey-based computing cluster for 2010, 2050, and 2090 (250 simulation years). The Contractor shall pursue developing wildfire-related $PM_{2.5}$ estimates for all years from 2010 to 2100 (920 simulation years). The Contractor shall proceed in several stages: (1) developing a memorandum; (2) validating and completing additional air quality runs to develop full transient for 21st century; (3) modifying the BenMAP-CE code as needed; (4) applying the methodology and assessing results for potential journal article(s) for peer review.

Task3.a: Memorandum

The Contractor shall write a memorandum proposing an approach to estimating the human health impacts attributable to wildfire-related $PM_{2.5}$ concentrations for the full 21st century time period. The memorandum shall further identify the relevant sources of input data, including air quality, population, baseline incidence rates, effect coefficients and other data. The memorandum shall describe a proposed methodological approach for quantifying wildfire impacts in BenMAP-CE, including data sources, proposed outputs/metrics, and anticipated challenges/limitations.

Task3.b: Validation and completion of GCHP model runs

The Contractor shall identify a candidate computing cluster that both matches the hardware requirements for successful GCHP installation and provides sufficient computing capacity in the near term to provide rapid analysis of 920 simulation years. After installation, an initial set of GCHP model results shall be validated against existing runs from work assignment 3-04 before running all simulation years. Contractors should develop a searchable database of fire-related PM2.5 concentrations that can be used to support future reduced-form analyses of projected meteorological conditions.

Task 3.c: Modify the BenMAP-CE code and produce estimates of health and economic impacts

The Contractor shall design and conduct BenMAP-CE runs for the coterminous U.S. to estimate mortality impacts associated with results within fire-related $PM_{2.5}$ concentrations database developed under Task 3.b. To the extent needed, the Contractor shall identify, select, and if necessary format for use in BenMAP_CE all relevant air quality, baseline health, demographic, and health and valuation impact function data for each model run. The Contractor shall modify v1.4 of the program previously developed to perform multi-pollutant analyses. The Contractor shall modify BenMAP-CE so that:

- Users can account for effect modification of air pollution effects by wildfire
- Users can define wildfire parameters in the program

- Users can assign health impact functions to user-defined discrete geographic areas.

As above, these changes may require the Contractor to modify the user interface and program logic. For these reasons, the Contractor shall reference closely the system design document and consult regularly with the WAM. The Contractor shall not modify the source code until the WAM approves this project plan.

The Contractor shall develop summary tables, graphs, and/or maps of results of changes in mortality incidence and monetary benefits of avoided premature mortality throughout the US due to changes in wildfire incidence in the Western U.S. in future years.

Task 3.b: Apply methodology and assess results for potential publications
In coordination with EPA staff, the Contractor shall apply all methodology outlined above and assess the potential for 1) one or more manuscripts describing results of the wildfire PM analysis; 2) further analyses; and/or 3) an alternative form of communication or publication of searchable database (e.g. online open-access publication of approach/data, such as GitHub). The Contractor shall provide recommendations for publication sources and draft or create sections of manuscript text (e.g. methods section; documentation of inputs, assumptions, limitations), user instructions (e.g. readme files), or data tables, based on the approach determined through discussions with the WAM.

3.1 Approach memorandum
3.2 Searchable databased of fire-related $PM_{2.5}$ concentrations
3.3 Summary tables, graphs, and/or maps of health and economic results
3.4 Recommendations for potential publications

Task 4. Respond to production requests

Task 4.a. Respond to quick-turnaround requests
The Contractor, as directed by the COR, shall provide technical support on quick turnaround activities related to quantifying the human health impacts of air quality pollutants. This may entail preparing additional communication or background materials, such as brief memos, figures, or powerpoints, for conferences, presentations, or briefings. The Contractor shall complete approximately 2-4 of these quick turnaround requests with each requiring about 10 hours. The schedule of deliverables for these quick turnaround and technical support requests will be included in the technical direction given by the COR.

Task 4.b. Respond to risk analysis requests
The aeroallergens and wildfire work conducted in the previous work assignment were conducted as part of EPA's impacts and risk analysis (CIRA) project. The Contractor, as directed by the COR, shall provide technical support on quick turnaround activities related to the CIRA project. In addition, the contractor, as directed by the COR, shall provide technical support for EPA's efforts to estimate both the physical and monetary impacts for marine fisheries nationally or regionally, using

a consistent analytic framework. To support this effort in this and future option periods, EPA anticipates contribution to modeled estimates of economic activity and assistance in the transfer of appropriate scenarios and data necessary for the effort.

VI. REPORTING REQUIREMENTS:

All reports shall be in accordance with contract specifications. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by OAQPS's windows-based word-processing (Microsoft Word 2007), graphics (Microsoft PowerPoint 2007), spreadsheet (Excel 2007), and database (Access 2007) programs.

VI. QA Requirements:

The Contractor shall include a quality assurance section in the final report discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

VIII. DELIVERABLES:

The Contractor shall adhere to the following schedule:

Task	Deliverable	Delivery Schedule
1a	Cost estimate	20 days after effective date of WA
1b	System design document	Ongoing
2a	Approach memorandum	1 month after the effective date of the WA
2b	Modified version of BenMAP-CE	7 months after the effective date of the WA
2c	Manuscript for publication	9 months after the effective date of the WA
3a	Approach memorandum	1 month after the effective date of the WA
3b	Searchable database	11 months after the effective date of the WA
3c	Summary results	12 months after the effective date of the WA
3d	Recommendations	12 months after the effective date of the WA
4	Quick turnaround	Duration of work assignment